

Unit Planning Guide: Grade 9 Unit 6 of 8

Unit Title: Functions	Pacing (Duration of Unit): 3 weeks
Grade: 9	Buffer Day(s): 00

Desired Results

Transfer Goals

Students will be able to independently use their learning to:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Established Goals (2011 MA Curriculum Frameworks Standards Incorporating the Common Core State Standards)

Standards (Priority Standards in bold):

- **F-BF.1 Write a function that describes a relationship between two quantities.**
- F-BF.1a Determine an explicit expression, a recursive process, or steps for calculation from a context.
- F-BF.1b Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*
- F-BF.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.
- F-BF.3 Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*
- **F-BF.4 Find inverse functions.**
- **F-BF.4a a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse and write an expression for the inverse. For example, $f(x) = 2x^3$ or $f(x) = (x + 1)/(x - 1)$ for $x \neq 1$.**
- **F-IF.1 Understand the concept of a function and use function notation. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a**

WiDA Standards (ELL)

Standard 1: ELLs **communicate** for **Social and Instructional** purposes within the school setting
Standard 3: ELLs **communicate** information, ideas and concepts necessary for academic success in the content area of **Mathematics**

In the lesson planning stage, teachers will need to differentiate lessons for ELLs. In order to accomplish this they will need: 1.) this curriculum map, 2.)

function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x . The graph of f is the graph of the equation $y = f(x)$.

- **F-IF.2** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- F-IF.3 Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n + 1) = f(n) + f(n - 1)$ for $n \geq 1$.*
- **F-IF.4** Interpret functions that arise in applications in terms of the context. **4.** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*
- **F-IF.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*
- F-IF.7e Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- F-IF.8b Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, and $y = (1.2)^{t/10}$, and classify them as representing exponential growth or decay.*
- **F-IF.MA.8c** Translate among different representations of functions and relations: graphs, equations, point sets, and tables.
- **F-IF.9** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
- F-IF.MA.10 Given algebraic, numeric and/or graphical representations of functions, recognize the function as polynomial, rational, logarithmic, exponential, or trigonometric.
- F-LE.5 Interpret the parameters in a linear or exponential⁵¹ function in terms of a context.

a list of their ELLs and their proficiency levels, and 3.) appropriate language function expectations and scaffolds or supports.

To be completed in collaboration with the ELL Department

Meaning (*Mostly assessed through Performance Tasks/Assessments)

Big Ideas: (Statements and concepts written in teacher friendly language which reflect the important [but not obvious] generalizations we want students to be able to arrive at. These are used by the teacher to focus daily instruction.)

- Situations can be represented by writing a function.
- Translate between table, graph, story, and equation.
- The graph of the inverse function is the reflection of the original function across the line of $y=x$.
- Functions can be defined by their parent function, domain and range, and end behavior.

Essential Questions: (Questions which frame ongoing and important inquiries about the big ideas. They are written for students and used in daily instruction to help engage students in meaningful thinking.)

- What does a function look like?
- What is the best way to represent a function?
- What is the purpose of an inverse function?

Acquisition (*Mostly assessed through traditional summative assessments)

Knowledge: Key basic concepts, facts, and key terms (written in phrases) students should be able to recall independently.

Students will know ...

- How to evaluate a function
- Find and graph the inverse of a function
- Represent a function in multiple representations
- Describe a function in terms of max/min and symmetries
- Identify the parent functions of linear, quadratic and exponential functions
- How transformations affect the parent function

Skills: The discrete skills and process students should be able to use independently (Bloom's Level of Learning should be noted in parentheses.)

Students will be skilled at:

- Writing a function where appropriate to represent a situation.
- Evaluating functions
- Finding inverse of functions
- Applying the vertical line test
- Graphing a function and the inverse
- Creating a function based on a table
- Transforming a parent function
- Identifying domain and range